or pleasure, and desire to have some knowledge of the principles underlying the design and working of the particular machines they employ. The steam turbine has been rather inadequately treated in comparison with the reciprocating steam engine, but perhaps this was inevitable in a book of this nature, as the latter is still practically unchallenged by its younger rival in many branches of work in which motive power is required.

This is a book which will probably stimulate many of its readers to widen their knowledge of the problems concerned with the generation of energy, and to devote themselves to a systematic study of the subject, and, if it fulfils this, it will have done useful work. T. H. B.

Photomicrographs of Botanical Studies. Pp. 62. (Manchester: Flatters, Milborne and McKechnie, Ltd., n.d.) Price 2*s.* net.

THIS booklet contains about a hundred plates, which are photographic reproductions from the microscopical slides offered by the firm above-mentioned for the use of botanical students. The chief impression conveyed by the figures is the limitation imposed upon good microscopical preparations when referred to one focal plane as necessitated by photography. While the value of good slides for demonstration and examination by students is appreciable, one cannot attach much importance to figures which are primarily indices and convey in many cases only a portion of the information that can be derived from the preparations.

Illustrated Guide to the Museum of the Royal College of Surgeons, England. Pp. vi+132. By Prof. Arthur Keith. (London: Issued by order of the Council of the College, and sold by Taylor and Francis, 1910.) Price 6*d.*

FEW even of those who constantly make use of the College of Surgeons' Museum can be aware of the vast wealth of material stored there. For it contains not only the greatest anatomical collection in existence, representative of everything included under the term "anatomy" in its widest sense; but it also includes a unique pathological museum, and collections illustrating anthropology, teratology, odontology, and the anatomy of animals and plants, each of which, if standing alone, would make a famous museum. Nor does this exhaust its claims on our interest, for in it is housed the famous collection made by John Hunter, innumerable anatomical and pathological preparations that have served as material for the master-builders of the sciences of anatomy and pathology, and specimens illustrating the history of all that relates to the preservation of dead bodies (starting from the earliest known mummy), the evolution of surgical and dental instruments, and the manifold curiosities of medical science which at various times engaged the attention of the ever-inquisitive Hunter.

The council of the college has earned the gratitude of a very wide circle of students in issuing this "guide," which admirably serves its purpose of indicating what the museum contains and where the various specimens are to be found, and Prof. Keith deserves our heartiest congratulations on the manner in which he has accomplished his task. For he has done something more than merely direct the reader in his wanderings through the vast storehouse of treasures in his charge; out of the abundance of his knowledge and erudition he has crammed a vast amount of interesting and suggestive information into this small volume.

This is only one, and by no means the least, of the many great services which have already marked Dr. Keith's conservatorship of the college museum.

The Photographic Annual, 1910–11, Incorporating the Figures, Facts, and Formulae of Photography. A Guide to their Practical Use. Edited by E. J. Wall. Sixth edition; extended, largely re-written, and revised. Pp. viii+287. (London: G. Routledge and Sons, Ltd.; Dawbarn and Ward, Ltd.; New York: Tennant and Ward; Melbourne: Baker and Rouse Proprietary, Ltd., 1910.) Price 1*s.* net.

EVERY photographer knows the value and utility of this annual issue, and that this is the sixth issue is sufficient testimony to its merits. There is no doubt that, in preparing such a work as this, and to keep the volume within a reasonable size, great difficulty must be experienced in determining what information to include or omit. The editor has used his discretion wisely, with the result that the present issue should meet with general approval among photographers.

The importance and recent advances made in screen-plate colour-photography is sufficient reason for the first forty pages being devoted to this subject, and here the reader will find a capital *résumé* of the state of affairs up to the present time. Stereoscopic work is next dealt with, and in the twenty-seven pages in which this subject is treated many useful hints will be found. Nearly the same amount of space is confined to some useful notes on development, including time, tank, and thermo methods. Practically the remainder of the book is taken up by the figures, facts, and formulæ, which always form the chief feature of this book.

Being well up-to-date and in a handy form the book should continue its useful career.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Ratio between Uranium and Radium in Minerals.

IN his interesting letter (NATURE, August 25) Mr. A. S. Russell describes the result of a determination of the amount of radium in a specimen of autunite from Autun, France, made by him in Prof. Marckwald's laboratory, which he found to be only 27 per cent. of the equilibrium amount. The ratio found by Mlle. Gleditsch in Mme. Curie's laboratory for the same mineral was 80 per cent., while Miss Pirret and I recently, for an autunite from Guarda, Portugal, found 44 per cent. Some results I have obtained since the paper with Miss Pirret was published appear to put a new complexion on the matter. Dual measurements of the radium ratio and of the helium content of several specimens of Portuguese autunite have shown that both vary considerably for different specimens of the same mineral. Prof. Piutti ("Helium in Recent Minerals," *Le Radium*, 1910, vii., 178) found that autunite was the only radio-active mineral in which helium could not be detected.

With a very delicate method, similar to that described for the detection of the helium produced from uranium and thorium (*Phil. Mag.*, August, 1908), I have only failed to find helium in one specimen of autunite, while in another the amount was such that Prof. Piutti would have detected it easily. The latter case refers to the specimen for which Miss Pirret and I found 44 per cent. for the radium ratio. The amount of helium was 3·3 cu. mm. per gram of uranium. On the assumptions, which certainly are not true but may not lead to an entirely false result, that the uranium was initially free from all products, and these have been all retained by the mineral, the age of the mineral would be 77,000 years and the period of average life of the parent of radium 132,000 years. The material was, however, not a single piece, a batch of

specimens containing 40 per cent. of autunite, obtained direct from the mining syndicate, having been ground up together. From a fresh batch, obtained through a dealer, two single pieces were picked out, the first being an almost pure crystal weighing 2·3 grams, and of so fresh and new appearance that it looked as if it had been withdrawn from its mother-liquor but yesterday, and the second an obviously older looking, greener, and much larger mass containing 46 per cent. of matrix. The first gave a radium ratio of 70 per cent., and in it helium could not be detected. The quantity was not greater than 0·002 cu. mm. per gram U. This quantity would form in about thirty years! For the second, the radium ratio was 44 per cent. and the helium 0·035 cu. mm. per gram U, which would be produced in about 600 years. Lastly, Mr. Russell very kindly gave me the remains of the specimen for which he found 27 per cent. for the radium ratio. It weighed less than 0·5 gram, but the helium was easily detectable. It amounted to more than 0·15 cu. mm. per gram U, some being lost.

If these results are representative, the radium ratio decreases to a minimum and then rises more slowly as the helium content increases. If the latter is taken as a measure of the age of the mineral, the minimum appears to be reached after a few thousand years. This, of course, is exactly what would occur if, when the autunite was formed, the radium (but not its parent) associated with the uranium in its former condition separated with the latter. This in itself is not only possible, but probable, owing to the isomorphism of radium and calcium. But it is a somewhat startling result if initial radium can have any influence on the amount present in a mineral to-day, for this necessitates that the ages indicated by the helium content are not altogether below the truth, and that these beautiful crystals are actually even now in full process of formation.

FREDERICK SODDY.

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Stagnant Glaciers

IN the notice of the Professional Papers of the U.S. Geological Survey on the "Glaciers, Goldfields, and Landslides of North America," published in NATURE of July 21, attention is directed to the peculiar stagnant condition of some glaciers, and to the fact that certain glaciers, after being stagnant for long intervals, suddenly commence to move.

Although the movement of glaciers is such as would take place if they were viscous bodies, there is reason to believe that they have not all the same viscosity. I pointed out in a paper communicated to the Royal Society (Proc. Roy. Soc., 1908, p. 250) that the calculated viscosities of several Swiss glaciers varied from $292{\cdot}2\times10^{12}$ to $3{\cdot}17\times10^{12}$ C.G.S. units. Although some of the data upon which these figures were based were only estimated ones, I do not think that the different viscosities found are due wholly to errors in the data. In other words, that the viscosity of glacier ice is not a constant, as in the case of water, &c., but varies with variations in the granular structure of the ice, or that there is a limiting stress below which distortion does not take place as with plastic bodies.

So far as I am aware, no glaciers have been proved actually to be stagnant by careful measurement. Generally speaking, the conclusion that a glacier is dead is formed owing to the absence of certain features which are generally associated with glacier movement.

It is very desirable that such statements should be based upon actual measurements only, and also that the actual granular structure of the ice should be given, for there is every reason to believe that the viscosity of glacier ice varies with the size of the glacier grains. Were it not for the fact that the glacier grains are actually broken up by shear planes in the ice, they would gradually become larger and larger until they became so large, and the viscosity became so great, that the ice would scarcely move at all on small slopes. In such a case an earthquake might give rise to fractures in the ice, and by temporarily decreasing the viscosity increase the rate of flow.

R. M. DEELEY.

Melbourne House, Osmaston Road, Derby, July 23.

IT chanced, strangely enough, that Mr. Deeley's interesting letter reached me at a Norwegian port during the return journey of the Geological Congress party from Spitsbergen, on which Prof. R. S. Tarr, whose work has given rise to the letter, is a fellow-traveller with me. I have therefore taken advantage of the opportunity to discuss the subject with Prof. Tarr and other glacialists of our party.

Mr. Deeley is right in his supposition that the stagnant condition of the "dead ice" in Alaska has been inferred from surface indications, and has not yet been tested by actual measurement. It is, indeed, not likely that the ice of the areas described as "stagnant" is absolutely motionless, nor do I think that this has been implied in the descriptions. Such motion as it may have must however be very small, since it seems that the trees covering parts of the surface-moraines in the "dead" areas show no sign of disturbance.

As hinted in my review, it is evident that rapid advances of glaciers, comparable to those observed in Alaska, have taken place in regions where some other cause than an earthquake must be sought. During our recent journey in Spitsbergen, of which I hope shortly to give some account in these pages, we have been shown by our leader, Prof. G. de Geer, several cases of this kind which he has studied. It may be that Mr. Deeley's explanation of ice-structure will explain these rapid spasmodic movements, but I shall not venture upon a discussion of this difficult physical question. Mr. Deeley has at any rate suggested a line of research which ought to be followed up and experimentally tested in the field.

Stockholm, August 19. G. W. LAMPLUGH.

The Leaning Tower of Pisa.

THE photograph of the "Leaning" Tower of Pisa in NATURE of August 4 shows clearly that the top tier is not square with the rest. From a rough alignment with the edge of a postcard, the photograph appears as if the tower was of the order of 25 mm./metre out of plumb when the top tier was put on presumably plumb.

Exact measures of this and of other parts of the tower might afford interesting data as to the epochs of the construction of the tower and of the progress of its "leaning."

EDWARD G. BROWN.

THIS famous tower will doubtless always be a question, like the man in the iron mask and other historical mysteries. Most architects, however, will be very slow to believe that it would have been built intentionally leaning on the general grounds that, however adventurous the architect, the clients would not have stood it. The analogy of the leaning towers of Bologna is hardly a sound one, as these plain shafts of brickwork, much like tall chimneys, can hardly be other than cases of settlement due to indifferent foundations. It should be remembered that construction was not a strong point with the Italians in the Middle and Renaissance Ages. In the case of the Tower of Pisa, Taylor particularly remarks on the wedge-shaped courses, which show an attempt to straighten the shaft. The best explanation appears to be that the tower was commenced, settled on its marshy bed, and that when the building was continued after a long interval it was considered safe to continue the work up to the limit of stability which could be calculated by the mathematicians of the epoch. The overhang is given by Taylor as 13 feet.

It is rather a pity that so much attention is concentrated by visitors on the tower, whereas the cathedral, Campo Santo, and particularly the Baptistery, are monuments of greater architectural importance. The design of the Baptistery is extremely interesting, and is perhaps the nearest expression of a Gothic dome.

The construction in this case is highly interesting because the outer dome is supported by a cone, as at St. Paul's, London, but without an inner dome. As, however, the cone is not illuminated from the inside, it has a domical effect. The top of the cone shows externally, to the detriment of the general outline, not being cut off to carry a lantern as at St. Paul's.